XVI.—*A Month on the Eddystone: a Study in Bird-migration.* By William Eagle Clarke, F.L.S. &c.

For many years past I have annually made peregrinations to favourably situated localities, both at home and abroad, during spring and autumn, for the purpose of observing the migratory movements of birds. The practical experience thus gained has been of incalculable value to me in the preparation of the various Reports which I have from time to time submitted to the British Association on the subject of Bird-migration in Great Britain and Ireland.

Varied as to time and place and withal successful as these numerous expeditions have been, yet until 1901 I had practically failed to obtain satisfactory knowledge, by direct personal observation, as to one of the most important phases of the phenomenon—namely, that of emigration. That this should have been the case is not difficult to realize when it is remembered that emigration is the movement of all others which is performed under conditions of obscurity. Thus it is chiefly—and entirely in the case of the majority of species—undertaken during the hours of darkness, so that it escapes the notice of all save those few peculiarly placed observers, the light-keepers ; and even they, however watchful they may be, witness a mere fraction of the movements that actually take place in close proximity to their stations, for it is only under certain meteorological conditions that the migrants seek the beacon's light and reveal themselves to the watcher, if there be one ready to watch.

I therefore determined, if possible, to spend a month in such a station for the purpose of perfecting my experience in what has long been a favourite study, and in the belief that a trained observer, prepared to devote the whole of his time to the necessary vigils, might, even in so short a period, during the height of the migratory season, add considerably to the knowledge of these important movements.

It required but little consideration to decide that autumn was obviously the best season, that the south coast of England was the best section of our littoral on which to

witness the departure-movements from Britain, and that an ideal watch-tower would be one situated well out in waters of the English Channel, for there the birds could be observed actually *en route* from our Islands to their southern winter-quarters, and there, too, the movements would be free from the complexities, due to coasting-propensities, so common to birds at most land-stations. The famous Eddystone Lighthouse offered all these advantages.

On making known my project to Professor Newton, he, with his characteristic kindness, at once offered his valuable assistance, with the result that, through his instrumentality and that of Sir Michael Foster, my application for permission to reside in the Lighthouse was forwarded to the Trinity House by, and with a strong recommendation from, the Royal Society. The request was most graciously granted by the Elder Brethren, and I took up my residence on the Eddystone on the 18th of September last and remained there until the 19th of October.

Life on a rock-station has, of course, its little trials. He who seeks to dwell therein must, among other things, be prepared to share in all respects the lot of the keepers, and also to be shut off from communication with the outer world until the monthly "relief" comes round, when, weather permitting, his incarceration ends and he returns to the ordinary comforts of everyday life. I may say at once, however, that the novelty of the situation, the interesting nature of my self-imposed work, and last, but not least, the great kindness of the keepers, far outbalanced those little discomforts which are inseparable from such a life; and I shall ever look back upon my sojourn in that lonely observatory with extreme pleasure and satisfaction.

The Eddystone rocks consist of three contiguous reefs, which lie fourteen miles south-west of Plymouth. The central reef is the most extensive, its exposed length at low water being some 150 yards, while its jugged crest then rises about 15 feet above the sea. At high water all the rocks are either submerged or have their highest points awash. The lighthouse stands isolated at the northern extremity of the

main reef, and is a massive structure 168 feet in height. The gallery, which was the scene of my perambulations and vigils, is 130 feet above the sea. The illuminating apparatus consists of a double series of dioptric lenses, one plsacd above the other, each furnished with a six-wick lamp, and deveolps the enormous power of 80,000 candles. In clear weather, however, only one lamp is used, full power being burnt when the Breakwater Light at Plymouth, eleven miles distant, is invisible. The light is concentrated into twelve brilliant beams, arranged in pairs, which revolve slowly, taking three minutes to make a complete circuit. On the adjacent reef to the north, and about forty yards distant, stands the basal portion of Smeaton's historic tower, erected in 1758 and in use down to 1882, a memorial to the genius of the founder of the science of lighthouse-engineering.

Landing on the rock is somewhat exciting work, and is effected from a surf-boat towed out by the relief steamer for the purpose. This boat approaches the rock at low water, and anchors some little distance off the lighthouse, while those landing have to dangle from a loop in a rope, clinging to the same with their hands as they pass over the intervening surf, the rope being payed out from the boat and hauled up by the winch in the lighthouse. The only real difficulty about this novel method of landing is to get nicely clear of the bow of the boat, and to avoid dropping into the water when the order "heave away" is given to the men at the winch.

As I anticipated, I found the Eddystone to be favourably situated for observing emigration, and, though it is probably only one among many points at which the Channel is crossed by birds on passage, yet its geographical position must be regarded as somewhat exceptional, since many migrants which have travelled along the west coast of Britain doubtless proceed further south in its proximity. The waters of the Channel in the longitude of the Eddystone—*i. e.* between the easternmost point of the south coast of Cornwall and the westernmost part of Brittany—are 115 miles in width.

The amount of success which it was possible to achieve

during my visit was dependent to an extraordinary degree upon the weather. This was especially the case as regards night movements ; for it must be borne in mind that conditions which are eminently favourable for migration may be, and indeed in most cases are, quite unfavourable for its observation. Successful night observation I found to be entirely dependent upon a combination of meteorological conditions which, while being favourable for emigration, also rendered the lantern attractive to the migrants—a combination which, though not very uncommon, is yet one of which the comparative infrequence results in the great majority of movements being unobserved. The lantern of a light-station is simply a decoy. It is one that I found to "work" only under peculiar conditions, which were dependent upon the amount of moisture (rain, haze, cloud) present in the atmosphere. When moisture is disseminated through the air as a liquid in a state of minute subdivision, the mixture becomes more or less opaque, while the powerful beams streaming out from the lantern upon it become luminous and brilliant to a very remarkable degree, and exert extraordinary attractive powers over the migrants that pass within their sphere of influence. On such occasions the twelve slowly revolving rays from the Eddystone lantern presented a very singular and mystifying appearance, and small wonder was it that the emigrants could not resist their seductions.

My visit included a period when the nights were brilliantly moonlit and cloudless, during which, no doubt, great passage-movements were performed, but they were beyond the range of observation. Gales were not infrequent and arrested emigration.

The first emigratory movement performed during the hours of darkness which I was to witness set in at 3 A.M. on September 23rd. I say "set in," because just previously to its advent the weather was of such a description as to render migration impossible, owing to the prevalence of a south-easterly gale with a velocity of from 40 to 48 miles an hour.

Just before the time named, however, the wind fell to a moderate breeze, but the heavy rain still continued. Almost immediately after the wind moderated, the birds appeared in numbers, and the scene from the gallery was very remarkable. The birds were flying around on all sides, and those illumined by the slowly revolving beams from the lantern had the appearance of brilliant glittering objects, while the rain shot past on either hand, as I stood on the lee side, like streams of silver beads. I was not a little disappointed to discover how extremely difficult it was to identify the birds seen under such novel and peculiar conditions. Even the conspicuous spots on the breasts of the Song-Thrushes as they flew in the beams towards the lantern were entirely effaced by the dazzling brilliancy of the light, and the smaller species had to be lifted from the lantern ere their identity could be ascertained; while the birds careering around became mere apparitions on passing the rays into the semi-darkness beyond. A number of species undoubtedly escaped detection; but the following are known to have participated in the movement, those marked with an asterisk (on this and other occasions) having been either killed or captured:—Song-Thrushes, *Redstarts, *Sedge-Warblers, *Pied Fly-catchers, *Yellow Wagtails, Turtle-Doves, Redshanks, and Curlews. The Song-Thrushes, Yellow Wagtails, and Turtle-Doves were most in evidence.

The Turtle-Doves were a great puzzle; for though they often approached the lantern, yet they recovered themselves sufficiently to avoid striking it, and it was not until day-break, when one was observed resting on the top of Smeaton's tower and another on the dome of the light-house, that the mysterious strangers stood revealed. The Yellow Wagtails captured included both adults and young.

The birds which struck the lantern did so after travelling directly up the beams of light; but a number of them flew high and passed over the dome. The emigrants came from the north and continued to arrive and pass on until 5 A.M., but before the appearance of dawn the movement ceased.

This rush was evidently composed of departing British

summer visitors, spurred to move southwards by the very unsettled weather of the previous few days. I witnessed no second movement of a precisely similar nature, though, no doubt, other flittings away of our summer birds followed; but the nights were brilliantly fine, and the migrants passed southwards unobserved. On this occasion the lantern was attractive to the birds by reason of its rays being rendered unusually luminous as they streamed out on the heavy rain which prevailed.

This movement was followed by several minor emigrations: that is to say, they were less important so far as they came under observation.

On September the 30th, at 9.30 P.M., following a lifting of fog (wind E.S.E., moderate breeze, hazy), *Song-Thrushes, *Meadow-Pipits, *Chaffinches, and other undetermined species appeared. The movement ceased to be observed on the appearance of the moon at 10.45 P.M.

October 1st.—Numbers of *Meadow-Pipits passing from 2 A.M. to 5 A.M. (wind S., moderate breeze). At night, on the rolling away of fog at 9.45, and during intervals of light rain up to 11.15, *Starlings (first) and *Wheatears (first) appeared at the lantern (wind S., moderate breeze, cloudy).

October 10th.—After a gale of three and a half days' duration, the night of the 9th was clear and starlight, with a gentle breeze from the N.N.W.; at 2 A.M. the sky became overcast, and *Song-Thrushes, Mistle-Thrushes (first), Redwings (first), *Skylarks, *Starlings, *Meadow-Pipits, and some undetermined Passerines appeared and were observed until 3.30 A.M. This was the first movement in which Birds of Passage were undoubtedly present—that is to say, species (the Redwing, for instance) which, having arrived in Britain from the Continent, had traversed our shores and were seeking more southerly winter-quarters by crossing the Channel *viâ* the Eddystone.

October 10th–11th.—During passing showers, from 7.15 P.M. to 9 P.M., Song-Thrushes and Skylarks were present. At 4 A.M., under similar conditions, several Starlings were flying round the lantern. (Wind W.S.W., light breeze.)

October 12th.—During slight showers, between midnight and 2.30 A.M., Pipits, Starlings, and Song-Thrushes were flying in the rays. (Wind S.S.E., light breeze; dark; clear.)

Next followed the chief movement of the past autumn witnessed at the Eddystone. This great passage commenced at 7.15 on the night of the 12th of October, and continued without a break until 5.45 on the morning of the 13th. The weather was favourable for both emigration and observation. The wind was a gentle breeze from the north-east, and the very slight haze which prevailed made it necessary to burn full power in the lamps, whose rays were thus not only doubly brilliant but assumed extraordinary luminosity, and hence attractiveness, as they streamed out upon an atmosphere eminently suited for rendering them conspicuous.

The first birds to appear were a few Starlings, and from 7.30 they were present in numbers down to almost the very close of the movement. These were followed, in the order named, up to midnight, by Blackbirds (first), Skylarks, Stonechats (first), Redwings, Fieldfares (first), Wheatears, and Song-Thrushes. To this hour the birds had continued to arrive and pass on in a steady stream, while many struck the lantern. Soon after midnight a great increase in the emigrants was observed, and the movement assumed the character of a rush southwards. Song-Thrushes, Redwings, Mistle-Thrushes, Blackbirds, Starlings, and Skylarks then appeared in vast numbers, and were followed by Chaffinches, Grey Wagtails (several), Goldcrests (first), Fieldfares (first), White Wagtails (several), Meadow-Pipits, and Curlews. At 5 A.M. the movement received an impetus from a fresh arrival of most of the species named; among others, a Grasshopper Warbler struck the lantern and a small party of Wild Geese passed close over the dome, calling loudly as they flew. Most of the emigrants went steadily southwards, but many tarried, and the majority of the species named were present in some numbers until the first signs of dawn, when the movement waned; and at daybreak all, save a few Starlings resting in a dazed condition in the recesses of the windows, had passed

away. There were also many small Passerines and a number of larger birds—probably Waders, from their notes—present during the movement, but their identity was not established. The Skylarks, Starlings, Song-Thrushes, Redwings, and Blackbirds appeared to be the species most numerously represented, and vast numbers of them were observed; but certain of the smaller birds were almost equally plentiful. It would have been possible to have captured some of them in great numbers; and, as it was, the killed or injured and captured included 76 Skylarks, 53 Starlings, 17 Blackbirds, 9 Song-Thrushes, and examples of the Redwing, Mistle-Thrush, Stonechat, Chaffinch, Meadow-Pipit, Grey Wagtail, White Wagtail, Goldcrest, and Grasshopper Warbler (a young female of the year).

I retained the wings and some specimens of all these birds; and the bodies of the various Thrushes and Skylarks were served up at dinner for several days, and proved a most welcome relief from the tedium of salt beef, which had figured daily for some time past as the standing dish of our bill of fare.

A notable and important feature was the continual arrival, down to almost the very close of the movement, of fresh emigrants, not only of individuals of the kinds early noted but of other species which had not previously participated in it; for instance, the Meadow-Pipit did not appear upon the scene until as late as 4.50 A.M. This continuous succession of arrivals indicated, I think, that some of the birds had come from comparatively near localities on the mainland, while others had travelled from afar ere they reached the Eddystone on their flight southwards. The presence of the Redwing and the Fieldfare added an ultra-British complexion to the passage; and it is possible that others among the migrants, perhaps the majority of them, may also have been drawn from sources beyond the limits of the British Isles. In this connection it may be stated that all the Starlings captured at the lantern (on this and other occasions) belonged to the race having a purple head and green ear-coverts, which is said to be of Continental origin. Be

this as it may, it is a fact, not, perhaps, without significance, that the only specimens I have seen of this form elsewhere were obtained at the Spurn Head Lighthouse in the autumn, and were doubtless immigrants.

Throughout the movement, and especially when it was at its height in the earliest hours of the morning, the scene presented was singular in the extreme and beyond adequate description. Resplendent, as it were, in burnished gold, hosts of birds were fluttering in, or crossing at all angles, the brilliant revolving beams of light; those which simply traversed the rays were illumined for a moment only, and became mere spectres on passing into the gloom. The migrants which winged their way up the beams—and they were many—resembled balls or streaks of approaching light, and they either struck the lantern or, being less entranced, passed out of the rays ere the fatal goal was reached. Of those striking some fell like stones from their violent contact with the glass, while others beat violently against the windows in their wild efforts to reach the focal point of the all-fascinating light. Many of those that freed themselves from the dazzling streams came in sharp contact with the copper dome of the lantern, making it resound again, and then fell like flashes into the surf below, followed slowly by a shower of feathers resembling a miniature storm of golden flakes. Finally, above and below the madding crowd in the illumined zone, great numbers of the emigrants flitted around in dim confusion, and in almost weird contrast with the brilliant multitudes gyrating in the adjacent vistas of light. The accompanying babel of tongues was also a striking feature. These were not cries of gratification, but of surprise and alarm; and they varied from the loud rattling notes of the Blackbird and the harsh angry "churr" of the Mistle-Thrush to the faint and dainty twitter of the Goldcrest. Some Skylarks every now and then, under the impulse of excitement no doubt, broke out into a few notes of song. Not a few strange voices were heard, some probably uttered by species with whose ordinary notes one was quite familiar; but migrants, especially Waders, have a travel-talk which is,

as yet, an unknown tongue to most of us. Nor was it an easy matter to promptly assign a familiar note to its rightful throat when heard under such highly peculiar conditions, and to an accompaniment supplied by the roar of the surf on the surrounding reefs.

It was interesting to note the varying degree in which the mesmeric influence of the light was exercised over the different species. The Starling was the most susceptible subject present; and this clever bird became under the sway of the lantern not only a complete fool, but a seemingly willing sacrifice. It was quite fearless and indifferent to the presence of myself and the keepers on the gallery, for it hustled past us in unceremonious fashion to reach the lantern, and, being baulked on the threshold by the windows, made vigorous attempts to reach the seductive lamp, and then sat half-exhausted on the sills and sashes, drinking-in, as it were, the light until it became quite stupefied, and when picked off would sit contentedly on one's hand. Great numbers were removed from the lantern and cast over into the darkness below; but many of them immediately returned. The Skylark was nearly as frequent a victim. It came up in great numbers to the light, but not being accustomed to perch on such slight coigns of vantage as the metal framework of the lantern offered, it fluttered violently against the glass for a time and, becoming exhausted, sank prostrate on the gallery *. It would have been quite possible to have captured a thousand Starlings and as many Skylarks. It was otherwise with the various species of *Turdus*. These, though present in equal or even greater numbers than either of the species just alluded to, were not affected to anything like the same degree. The Blackbirds and Song-Thrushes approached the lantern more freely than the rest of their genus, but they had a habit of coming

* I may here remark that I took with me to the Eddystone a quantity of netting, with which I completely surrounded the gallery by hanging it perpendicularly from the railing. The object was to prevent any birds that struck from falling over. It answered admirably, and was the means of saving many birds which would otherwise have been lost.

up to some extent "side on," so to speak, and consequently they glanced off either little stunned or quite uninjured. These birds did not attempt to remain at the lantern, and those which were captured shewed extreme fear. The Redwing, one of the most numerous species present, was very shy, and still more so were the Mistle-Thrushes and the Fieldfares; the latter only approached the lantern and did not strike.

That this was a great movement, seen under favourable conditions, is evident from the fact that the senior keeper had only once before during his sixteen years' experience seen one of equal magnitude, namely at the Casquets off Alderney. The other keepers had not seen anything like it before. It appears to have been a far-reaching movement, too; for at the Bishop's Rock Lighthouse, south of the Scilly Isles and one hundred miles west of the Eddystone, a considerable migration was in progress at the same time, and Starlings, Thrushes, and Fieldfares are recorded as having been captured at the lantern. It was not, however, a great night for victims apart from Starlings and Skylarks; but had a thick drizzling rain replaced the thin veil of haze, the slaughter would, in the opinion of the keepers, have been appalling, so numerous were the emigrants and so long-continued their passage.

On the night of October 13th–14th, between 6.50 P.M. and 2 A.M., a few *Skylarks, *Starlings, *Song-Thrushes, *Chaffinches, several Turtle-Doves, and a *White Wagtail were observed at or around the lantern. The night was, on the whole, starlight and clear, but there were periods during which it was overcast, and then it was that the birds approached the lighthouse. (Wind E.S.E., gentle breeze.)

The White Wagtail had not hitherto been detected quitting our shores in the autumn. Its occurrence at the Eddystone lantern on the nights of the 13th and 14th of October is of further interest, since the dates are, I believe, the latest on record for the observation of this bird within the British area. Both the examples secured were young birds in winter plumage.

The last of the night-movements during my visit was one of considerable magnitude and remarkable interest. It set in on the night of October 15th, and was in progress until nearly daybreak of the following morning. The meteorological conditions under which it was witnessed were exceptional, and afforded a clear and unmistakable demonstration of the effect of weather-influences and the extent to which we are dependent thereon for rendering the observation of migratory movements possible. In this important respect it was one of the most valuable experiences that I had. The night was bright and starlight until 7.30 P.M.; but from that hour until daybreak the state of the atmosphere was ever oscillating between intervals of brightness and those during which the sky was overcast with a slight degree of haziness, rendering the Breakwater Light at Plymouth invisible, and full power necessary at the Eddystone. The wind was E.N.E. and varied in force from a moderate to a gentle breeze. After a little experience it became possible to tell, by watching the beams of light, what the atmospheric conditions of the moment and the chances of observation were. The beams grew conspicuous when the sky became overcast through the presence of moisture in the atmosphere, and then the birds immediately approached the beacon; but as soon as this condition passed away the rays at once thinned down and became little more than visible, the birds sheared off, and the movement in progress ceased to be observed. During the duration of the periods favourable for observation, between 7.35 P.M. and midnight, the following species were observed:—Song-Thrushes, Mistle-Thrushes, Redwings, Skylarks, Goldcrests, Starlings (first at 10.30), Blackbirds (11.30), Wheatears (11.45), Grey Wagtail, and Stonechats (midnight). At 9.40 a number of Waders passed, but their calls were in an unknown tongue. The period between 11.15 P.M. and midnight was the most productive of results. At intervals between 1 A.M. and daybreak Wagtails, Mistle-Thrushes, Goldcrests, Starlings, Larks, Wheatears, Wrens (1.15 A.M.), Song-Thrushes, Meadow-Pipits (2.30 A.M.), Redwings, Blackbirds, and Storm-Petrels were observed—the

chief periods being from 1 A.M. to 1.45 A.M. and from 2.30 A.M. to 3 A.M; but some of the species named were observed at intervals until daylight appeared. There was practically no tarrying at the lantern, owing to the attractive periods being so short in duration, and the observations afforded direct evidence that the movement was continuous and that it was in progress for at least ten hours.

The Song-Thrush and the Skylark appeared to be the most abundant species, and the latter was occasionally quite a nuisance at the lantern. The extreme scarcity of the Starling was remarkable, but, on the other hand, the abundance of the Mistle-Thrush was noticeable. The emigrants were at times very numerous, and though the atmospheric conditions were not greatly in favour of many striking the lantern, yet those killed included 11 Thrushes, 8 Larks, 3 Mistle-Thrushes, 4 Blackbirds, and examples of the Meadow-Pipit, Redwing, Goldcrest, Wheatear, Grey Wagtail, Wren, and Storm-Petrel.

I will now treat of the migratory movements observed during the daytime.

It will be well to preface the observations by remarking upon the great difficulty of detecting small birds at sea. This is chiefly to be accounted for by the fact that the surface of the water being ever in motion forms a most unsatisfactory background on which to "pick up" such birds on the wing. Dark or sober-coloured species are especially difficult to detect; but the few that shewed any white in their plumage during flight came under notice almost at once.

The day migrations of land-birds observed, though of considerable importance, were entirely confined to passage movements across the Channel in a due southerly direction. The species participating in these emigrations were few, and consisted chiefly of Meadow-Pipits, several kinds of Wagtails, and Swallows; but the number of individuals was very considerable. A few Willow-Warblers, Linnets, and House-Martins were also observed, but their numbers were

so small, and the occasions on which they appeared so rare, that they do not merit further consideration.

Daily throughout my visit when the weather was favourable, that is to say when a light wind prevailed, no matter from what quarter, the passage of Meadow-Pipits and Wagtails was of regular occurrence. The movements were performed during particular hours only, commencing soon after daylight—*i. e.* from 6.15 A.M. to 7 A.M.—and were entirely over by or before midday. So rigidly were these hours adhered to by the emigrants, that I soon found the afternoons to be quite unproductive, and consequently I regulated my hours of rest accordingly.

The Meadow-Pipits often passed in small parties, consisting of as many as a score, but frequently in twos and threes, and sometimes even singly; while the height of their flight varied from twenty feet, or less, above the water to occasionally as much as two hundred feet, the direction being due south. The birds were observed on emigration, in greater or less numbers, on sixteen days *, during which vast numbers passed close to the lighthouse: the passage being on some days continuous between sunrise and midday. The greatest movements were chronicled between September 30th and October 1st, 2nd, 3rd, 5th, and 15th. They invariably uttered their familiar notes as they flitted by.

On the same days, with hardly an exception, and during the same hours of the morning and forenoon that the Pipits were on the move, Wagtails, singly or in pairs—but never more than three together, and that seldom—were observed moving southwards. The species identified were the Pied, the White, and the Grey Wagtail; but in what proportion I was unable to determine, for it was only occasionally that the birds were seen under conditions which permitted of their being identified with certainty—chiefly when they broke their journey, as they sometimes did, and alighted on the reefs at low water. These birds generally flew at a comparatively considerable elevation, seldom below that of the gallery (130 feet),

* I was 32 days on the rock, and during that period 14 days were entirely unsuited for migration, owing to adverse weather-conditions.

and most frequently over 200 feet. Wagtails were noted as emigrating on thirteen days, and, judging from the continuous nature of their passage on these occasions, great numbers crossed the Channel towards the coast of France.

Swallows were observed passing southwards on seven days; possibly they did so on others, but they were particularly difficult to "pick up," even when close to the tower. On certain days (October 2nd and 15th), considerable numbers passed in small parties of a dozen or so, consisting of both old and young. The movements were all timed between 7 A.M. and 11.30 A.M.; and the first emigrant was noted on September 24th.

No East to West migration of land-birds was observed. That such movements occur regularly on the south-west coast of England during the daytime is well-established; but they are confined to the coast and its immediate vicinity, and their southerly fringe does not appear to extend to the Eddystone.

Few Waders came under notice, which is not surprising, for the pelagic nature of our surroundings offered no attractions to such visitors. The most interesting of the migrants among this group was the Red-necked Phalarope, which appeared singly on two occasions, namely, on the 21st of September and the 1st of October, during unsettled weather. The first of these visitors was a bird of the year, which remained for several hours in the vicinity of the tower, often approaching quite close to its base. The second was an adult in winter plumage, and was also under notice for a considerable time, frequently at close quarters. The 1st of October was a wild day, and the little bird was compelled to seek the lee of the lighthouse to escape the frequent squalls of wind and rain that swept past from the S.W. Both were assiduously and unceasingly engaged in the capture of some minute surface-swimming creatures, probably crustaceans, which must have been very abundant, judging from the lively actions of the Phalaropes in picking round in all directions with the greatest rapidity. They were restless, too, and constantly changed their quarters by a series of flights to

try fresh areas near at hand; often, however, to return in a few moments to spots which they had just previously quitted. While thus engaged they frequently approached the edge of the reefs and did not seem to mind the buffeting they encountered amid the broken water; now and then a shower of spray would cause them to rise on the wing, but, nothing daunted, they alighted again as soon as the disturbing element had passed.

On September 29th a small flock of Ringed Plovers passed the lighthouse flying rapidly due south, and evidently bent on crossing the Channel.

The Purple Sandpiper visits the reefs in the late autumn and winter to search for food during low water, returning to the mainland at high tide, when its haunts are submerged. The first bird of the season arrived on the 11th of October, and as many as four were seen from that date onwards. A single Turnstone was observed on the rocks on September 30th—an immature specimen.

A number of migratory marine birds also came under observation. Foremost among these in point of rarity was an example of Sabine's Gull, seen near the tower on the morning of September 29th. This bird was in an interesting stage of plumage, being an adult assuming winter dress. It was most accommodating in its behaviour, since it frequently rose and displayed its deeply forked and entirely white tail, and those conspicuous bands of white which cross the pinions—features which render this species both remarkable and unmistakable when on the wing. It sat on the water more buoyantly than the other Gulls around it, and was in general more elegant in form than any of them.

The next species deserving mention is the Sooty Shearwater (*Puffinus griseus*), described in the 'Birds of Devonshire' as "a very rare accidental visitor" to that county. I saw single examples on September 23rd, and on October 12th (two), 14th, and 19th, the last day being that of my departure. It is possible that this bird was not very uncommon just beyond the range of identification, where the shoals of Pilchards were frequent and proved a great attraction to various other

species. It will be well to mention here the Great Shearwaters. These birds were very common throughout my visit, but were seen in varying numbers ; on some days a few only skimming the waters around the lighthouse, while on others they were extremely abundant. When the immense shoals of Pilchards were in the vicinity, I witnessed some interesting scenes in which this species played a leading part, for it dashed into the water in spirited style to secure its prey ; as did also the less agile Gulls, upon whom, in turn, numerous Skuas were in close and pressing attendance. The whole formed a most animated scene ; one whose interest was occasionally further heightened by the presence of a school of small Cetaceans, which rolled and jumped about in all directions among the much persecuted fish. The Manx Shearwater was frequently seen between the 29th of September and the 14th of October, but was not at all numerous.

To return to the migratory species among the Laridæ. The occurrence of the Great Skua was chronicled on September 23rd, when three examples were observed during a S.E. by S. gale ; single birds were seen on the 1st and 16th of October. The Pomatorhine Skua was very abundant during the period covered by my visit, and was much in evidence when I left. Examples with remarkably developed central tail-feathers, and others in melanistic plumage, were not uncommon. The Arctic Skua was also common, but not nearly so numerous as the last-named species. The abundance of these piratical birds was no doubt due to the presence of vast numbers of Gulls of various kinds, and of these last, in turn, to the great shoals of Pilchards present in the neighbourhood of the Eddystone.

Of the various species of Tern I saw but few examples. This was, no doubt, due to the fact that the vicinity of the reefs, and the deep water that surrounds them, did not afford a suitable fishing-ground. Single examples of the Sandwich Tern were seen on the 25th and 27th of September. A few Common Terns passed on the 22nd, 23rd, 27th, and 28th of September ; and on the morning of the 12th of October two Arctic Terns, in the somewhat uncommonly observed stage

of immaturity which led to birds in that plumage being described as a distinct species under the name of *E. portlandica*, came close to the tower on their way westwards.

Storm-Petrels visited us on five occasions during unsettled weather. On September 22nd they were very abundant during a S.E. by S. gale, when many were engaged on the lee side of the tower in picking up food on the surface of the water, in the shape, I am inclined to think, of small particles of fatty matter from our refuse bucket. A few were seen on the 6th and 8th of October during gales, and one came to the lantern at 2.30 A.M. on the 16th.

When migratory birds did not present themselves, I found much to interest me in the habits of the Gulls, Gannets, Shags, and Cormorants, some of which were always present during the daytime. All the ordinary Gulls were observed, save the Common and the Black-headed species. I noted a fact regarding the food of the Herring-Gull which I have not found recorded in the standard works on British Birds, though it may have been elsewhere, namely, that this bird feeds extensively on seaweed, especially on the kind known as "sea-thongs" (*Himanthalia lorea*). Almost daily masses of this and other weeds drifted past on the tide, and each patch had one or more of these Gulls in attendance, busily engaged in detaching suitable pieces from the long orange-brown strings, which they swallowed with avidity. They often squabbled among themselves for the possession of such food-supplies. I never saw the Lesser Black-backs, which were present in considerable numbers, pay any attention whatever to these flotsam patches of weed.

The Gannets afforded special opportunities for observing their habits. These birds fished round the lighthouse in numbers, and with marked success, when the sea was rough or its surface agitated; but when the sea was calm and its surface glassy, they merely passed on their way to other fishing-grounds, well knowing that it was useless to attempt to capture the wily Pollack, the object of their quest, when there was no ripple on the face of the waters. The best fishing-grounds lay at the very edge of the reefs, and hence

quite close to the tower; and thus from my elevated and fixed point of observation on the gallery I was enabled to gauge the height from which these birds dived with a degree of accuracy not usually attainable. I witnessed many thousands of dives, but in no case did the drops exceed a height of from 130 to 140 feet. About one-fourth of the Gannets seen were in immature dress, all stages being represented except that of the year—a fact which is worthy of note.

The Eddystone was an excellent station for studying the weather conditions and their bearing upon bird-migration.

Birds when performing long flights not unfrequently pass from the zone of favourable weather, which is conducive to their departure, to an area in which the conditions are more or less unfavourable; and they are consequently recorded as arriving on our coasts in the autumn under adverse circumstances. Such inauspicious instances of immigration as these are apt to mislead those interested in the subject, for it is not always borne in mind that it is the state of the weather *at the point of departure* which affords the only indication of the actual conditions controlling the movements.

At the Eddystone, owing to its contiguity to the mainland, one witnessed simultaneously the movements and the meteorological conditions under which the birds elected to set out on their passage southwards; or if no movements took place, either by day or by night, one was able, it being the height of the emigratory season, to determine, in some measure at least, what the weather-barriers were which arrested such migrations. Thus this station was singularly favourably situated—probably none more so—for observing the meteorological conditions which made for or against emigration.

No movements were witnessed, either by day or night, on the part of land-birds under weather conditions which could be described as in the least degree unfavourable for crossing the Channel.

The wind is certainly the main factor in migration-

meteorology, and practically determines what is favourable and what is unfavourable for the movements. From observation, I am convinced that the *direction* of the wind is, in itself, of no moment to the emigrants, for they flitted across the Channel southwards with winds from all quarters *. It is quite the reverse, however, when its force or velocity comes to be considered, and I found that none of the movements, not even straggling flights during the daytime, were performed when the velocity of the wind exceeded 28 miles an hour (or force 5, fresh breeze, of the Beaufort scale). With the velocity of the wind at 34 miles an hour (force 6), odd Pipits and one or two young Swallows were seen in distress, and endeavoured to seek shelter at the lighthouse. The movement witnessed on the early morning of the 23rd of September afforded an interesting instance of the effect of the force of the wind on migration. On the wind falling from a velocity of 40 miles an hour (force 7) to 23 miles an hour (force 4), the other meteorological conditions (direction of wind and heavy rain) remaining the same, a great emigratory movement was initiated.

The prevalence of rain is evidently a matter of indifference to the birds. It is otherwise to the would-be observer, for the beams from the lantern assume additional luminosity during rain, and the birds, if migrating, are decoyed within the range of observation. On clear nights one is entirely dependent upon the intervention of a passing shower to learn whether migration is in progress or not, but on such occasions few birds actually strike the lantern, though many fly around it.

When fog prevailed no birds were observed, though the luminosity of the rays of light then assumes the maximum of its conspicuity, while not penetrating beyond the imme-

* The direction of the wind depends upon the distribution of atmospheric pressure. Certain systems of pressure establish fine weather conditions over the North Sea, and are thus eminently favourable for intermigration between the Continent and the British Isles. Consequently the winds, which are also the result of these particular pressure-systems, have erroneously come to be regarded as the main factors controlling these movements.

diate vicinity of the lighthouse. During fog, charges of tonite are exploded every five minutes and produce a terrific report, which must have a decidedly scaring effect on any approaching migrants, if such there be.

The only migratory species observed during gales were the single examples of the Red-necked Phalarope observed on two occasions. Certain other species, such as Skuas and Storm-Petrels, the latter especially, were much in evidence when the weather was unsettled and the wind high.

An important and interesting point in connexion with the phenomenon of emigration is the hour at which the emigrants set out upon their night movements. This, however, is a very difficult and obscure subject to investigate. No one, so far as I am aware, has ever witnessed the act of birds rising on the wing to depart on their nocturnal journeys; while the observations made at land-stations, which may be considered to bear upon the question, are surrounded by and associated with elements of great uncertainty. At the Eddystone, and other stations situated immediately off the south coast, it seemed possible in the autumn to procure data which might enable us to fix this time of embarkation with some degree of accuracy. To this end I made a series of careful observations on the time of first appearance of emigrants at the Eddystone, and found that on a number of occasions in October this ranged from 6.50 P.M. to 7.15 P.M. The species noted were Song-Thrushes, Skylarks, Starlings, and Chaffinches; but others were sometimes present, though not identified. On the dates on which these observations were made, the hour of sunset ranged from 5.30 P.M. to 6 P.M., but darkness did not ensue until about 6.15 P.M., or a little later. It is fair to assume that these earliest birds to appear had only a short time previously set out from localities contiguous to the shores of the mainland, some twelve miles distant. Taking these facts into account, I have come to the conclusion that when the weather conditions at the hour are favourable, the initial movement for crossing the Channel is embarked upon almost immediately after darkness prevails. During each major movement witnessed, neither the species

nor the individuals of a species appeared simultaneously, though sometimes several kinds arrived in company, and thus the passages were a succession of arrivals practically down to their close. Here we have evidence, I think, that certain of the emigrants had journeyed from districts more or less distant ere the Channel was reached on the voyage southwards.

On each occasion when a number of birds of any species was killed at the lantern, it was interesting to note how considerably they varied in size, and some, though to a less degree, in colour. The Skylarks, 76 in number, obtained during the great movement of October 12th–13th, shewed the remarkable range of wing-measurement of from 4·70 in. to 3·85 in.; the Starlings, obtained on the same date and 53 in number, from 5·38 in. to 4·85 in.; and the Meadow-Pipits from 3·37 in. to 2·91 in. The Skylarks and Meadow-Pipits exhibited some variation in colour, difficult to describe in words, but quite manifest to the observer. It is possible that more than one race of the two last-named species was represented during the movement, or it may be, in the case of all three species, that the peculiarities in size, &c., were due, in a greater or less degree, to age or sex, or both in combination.

As regards the characters which may distinguish the various continental representatives of many of our commonest species we as yet know extremely little; while the age of certain birds in the late autumn is not an easy matter to determine, nor do the histories of their plumages at that season appear to be sufficiently well known to help us to reliable conclusions on this point.

Wing-measurements are valuable as an indication of the range of variation within species, but speculations based upon ordinary material are apt to be extremely misleading. Here, again, sex and age, alone or in combination, may, and do, account for much of the variation to be found, and yet how insignificant are the data in our possession which afford these essential particulars!

As bearing directly upon these remarks, I will instance a

few cases that came under my notice at the Eddystone. In addition to those of the Skylarks and the Meadow-Pipits (which shewed a very considerable variation in size and certain peculiarities of plumage *inter se*, though all were obtained during single movements), the Starlings killed on the night of Oct. 12th–13th were all of one race, namely, the purple-headed form, and yet the wings of the males varied from 5·38 in. to 5·0 in. (four being over 5·25 in.) and of the females from 5·15 in. to 4·85 in. (13 being over 5 in.). Some, probably most, of this remarkable variation was due to age, much to individualism, none to race. This influence of age was well illustrated in the Blackbirds obtained; the wings of all the young males measured from ·30 to ·40 in. less than the adult. To be of any real use, beyond, of course, the important one of identification, all wings should be accompanied by the age and sex of the specimen from which they were taken, and it is important, where possible, to obtain a number of examples from the same movement. Until these essential data are forthcoming, it is impossible to realize the true significance of wing-measurements, and it is worse than useless to draw deductions from them.

On the question of the young and old birds travelling together or apart on their migrations, or in what species they do so, my observations at the Eddystone throw some light. Swallows, both adults and juveniles, were observed passing in company during the daytime; and young and old of the Mistle-Thrush, Redwing, Blackbird, Wheatear, Stonechat, Yellow Wagtail, and Skylark were obtained together at the lantern at night.

Since I left the Eddystone, the keepers have furnished me with a series of carefully filled-in schedules, wherein are recorded in detail all the observations up to date. I succeeded in thoroughly interesting them in the work.

A pleasant duty remains. I have to express to the Elder Brethren of the Trinity House my gratitude for the privilege they so graciously granted me. My thanks are also tendered to Captain Reading and to G. F. Treleavan, Esq., for the information and assistance they so kindly afforded me; and

to the light-keepers, Messrs. Ayers, Gilpin, and Hambling, for their great kindness, attention, and co-operation on all occasions during my residence on the rock. To Professor Newton and Sir Michael Foster my grateful acknowledgments are due for the kindly interest they took in the furtherance of my project: without their influential aid my visit to the Eddystone would not have been accomplished.

XVII.—*On* Anser erythropus *and its Allies.*

By J. H. Gurney, F.Z.S.

Mr. F. Coburn, of Birmingham, has announced in 'The Zoologist' (1901, p. 317) an event of considerable interest to British ornithologists, namely, that a Lesser White-fronted Goose, *Anser erythropus* (= *A. minutus* Naum.), was killed during the preceding January in Norfolk. I understand that this rare bird was taken in the Wash, and sent along with some Coots and Knots to a poulterer in Birmingham Market by a reliable fisherman at King's Lynn, but, of course, it is as likely to have been obtained on the Lincolnshire side as in Norfolk. The weather, when it was shot, was fine with westerly winds. Mr. Coburn has since been good enough to give me an opportunity of comparing his specimen with several examples of the White-fronted Goose (*A. albifrons*), and as its beak, which is the important feature, is intermediate in size between those of its two allies, I hope that a few remarks will not be out of place with a view to further establishing its identity, and also the specific value of the three closely allied species, *A. albifrons*, *A. erythropus*, and *A. gambeli*.

The American species, or subspecies, *A. gambeli* Hartl., is generally recognisable by its comparatively large beak and its blacker underparts. It ranges over the whole of North America, while there are three specimens in the Natural History Museum from Japan, where its range meets that of *A. erythropus*. Details of its distribution are given in 'North American Birds,' vol. i. pp. 448–454, and in the 'Catalogue of Birds,' vol. xxvii. p. 95. Opinions differ as to